Electronic Version

Stylesheet Version v1.1.1

Claims

[c1] A method of obtaining an image of the distribution of an internal property of an object by recording and processing the intensities of multiple rays that have passed through said object and have been attenuated by said property, said method comprising the steps of:

irradiating the object with one or more rays of energy from one or more localized energy sources with the rays going through the object to one or more detectors and recording the detected intensity of each ray;

acquiring said intensity or intensities multiple times with differing locations of the rays through the object;

creating for each ray a first array of numbers said numbers having a periodic modulation across the array with the amplitude of the modulation being determined by the intensity of the ray and with the frequency and direction of the modulation being determined by the location of the ray in the object;

adding each first array of numbers as a line or plane into a second array of numbers said second array having one more dimension than the first array with the location of the line or plane in the second array determined by the location of the ray in the object;

adjusting the numbers in the second array to correct for the non-uniform density of data in the second array; and performing a Fourier transform on the numbers in the second array thereby generating an image of the distribution of the property of the object.

[c2] A method according to claim *1*, in which the adjustment of the numbers to correct for the non-uniform density of data is performed on the numbers in the first array.

[c3] A method according to claim *1*, in which an adjustment is made to the amplitude of the modulation based on the length, width, or other geometric property of each ray.

[c4] A method according to claim *1*, in which at least one first array is added into the second array before all of the ray intensities have been obtained from the object.

[c5] A method according to claim *1*, in which the data to be added into the second array is calculated directly from the ray intensities without creating a first array.

[c6] A method according to claim *1*, in which the data to be added into the final image is calculated directly from the ray intensities without creating a first or second array.

[c7] A method of obtaining an image of the distribution of an internal property of an object by recording and process-

ing multiple projections of the distribution, said method comprising the steps of:

acquiring a projection of said distribution by irradiating the object with multiple rays of energy from a localized energy source with the rays going through the object to multiple energy detectors and recording the attenuation of the rays caused by said property;

acquiring said projection multiple times with differing locations of the rays through the object;

creating for each ray a two-dimensional array of numbers said numbers having a periodic modulation across the array with the amplitude of the modulation being determined by the attenuation of the ray and with the frequency and direction of the modulation being determined by the location of the ray in the object;

adding each said two-dimensional array of numbers as a plane into a three-dimensional array of numbers with the location of the plane in the three-dimensional array determined by the location of the ray in the object;

adjusting the numbers in the said three-dimensional array to correct for the non-uniform density of data in the three-dimensional array; and

performing a Fourier transform on the numbers in the three-dimensional array thereby generating an image of the distribution of the property of the object.

[c8] A method according to claim *7*, in which the adjustment of the numbers to correct for the non-uniform density of data in the three-dimensional array is performed on the numbers in the two-dimensional arrays.

[c9] A method according to claim *7*, in which an adjustment is made to the amplitude of the modulation based on the length, width, or other geometric property of the ray.

[c10] A method according to claim *7*, in which the two-dimensional arrays for a single source location are created and added into the three-dimensional array before the attenuation values are obtained from at least one other source location.

[c11] A method according to claim *7*, in which the data to be added into the three-dimensional array is calculated directly from the ray intensities without creating a two-dimensional array.

[c12] A method according to claim *7*, in which the data to be added into the final image is calculated directly from the ray intensities without creating a two-dimensional array or a three-dimensional array.

[c13] A method of obtaining an image of the distribution of an internal property within a slice of an object by recording and processing multiple projections of said distribution

within the slice, said method comprising the steps of:
acquiring a projection of said distribution within the slice by irradiating the slice with multiple rays of energy within the plane of the slice from a localized energy source with the rays going through the object to multiple energy detectors and recording the attenuation of the rays caused by said property;
acquiring said projection multiple times with differing locations of the rays through the slice;
creating for each ray a one-dimensional array of numbers said numbers having a periodic modulation across the array with the amplitude of the modulation being determined by the attenuation of the ray and with the frequency of the modulation being determined by the location of the ray in the object;
adding each said one-dimensional array of numbers as a line into a two-dimensional array of numbers with the location of the line in the two-dimensional array determined by the location of the ray in the object;
adjusting the numbers is said two-dimensional array to correct for the non-uniform density of data in the two-dimensional array; and
performing a Fourier transform on the numbers in the two-dimensional array thereby generating an image of the distribution of the property within the slice of the object.

[c14] A method according to claim *13*, in which the adjustment of the numbers to correct for the non-uniform density of data in the two-dimensional array is performed on the numbers in the one-dimensional arrays.

[c15] A method according to claim *13*, in which an adjustment is made to the amplitude of the modulation based on the length, width, or other geometric property of the ray.

[c16] A method according to claim *13*, in which the one-dimensional arrays for a single source location are created and added into the two-dimensional array before the attenuation values are obtained from at least one other source location.

[c17] A method according to claim *13*, in which the data to be added into the two-dimensional array is calculated directly from the ray intensities without creating a one-dimensional array.

[c18] A method according to claim *13*, in which the data to be added into the final image is calculated directly from the ray intensities without creating a one-dimensional array or a two-dimensional array.

[c19] Apparatus for obtaining an image of the distribution of an internal property of an object by recording and pro-

cessing the intensities of multiple rays that have passed through said object and have been attenuated by said property, said apparatus comprising:

a means for applying multiple rays of energy to the object in known locations relative to the object from a localized source of energy and for detecting the intensity of each ray;

a means of changing the either the location of the source or the location of the detectors or both relative to the object;

a means of calculating the F-component of each ray;

a digital storage means for the F-space array and a means of adding the F-component of each ray into said storage means;

a means of adjusting the amplitude of the numbers in the F-space array according to their position in the array;

a means of performing an inverse Fourier transform on the F-space data; and

a means of displaying and recording the resulting image.

[c20] Apparatus according to claim *19*, wherein the means for calculating the F-component is optimized for the specific geometry of the system.

[c21] Apparatus according to claim *19*, wherein the means for adding the F-component of each ray into said storage means is optimized for the specific geometry of the sys-

tem.